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No. 443.

SWAMP LANDS OF THE UNITED STATES.

LETTER

FROM

THE SECRETARY OF AGRICULTURE,

TRANSMITTING,

IN RESPONSE TO A SENATE RESOLUTION OF DECEMBER 9, 1907, INFORMATION IN REGARD TO THE LOCATION AND AREA OF SWAMP AND OVERFLOWED LANDS SUSCEPTIBLE OF BEING DRAINED FOR AGRICULTURE; THE EFFECT OF DRAINAGE UPON SUCH LANDS; THE AREA DRAINED UNDER THE LAWS OF THE DIFFERENT STATES AND THE BENEFITS WHICH HAVE RESULTED THEREFROM, ETC.

APRIL 21, 1908.—Referred to the Committee on Agriculture and Forestry and ordered to be printed.

DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, April 20, 1908.

To the Senate:

In accordance with the resolution of December 9, 1907, I have the honor to transmit, by direction of the President, information in regard to the location and area of swamp and overflowed lands in the United States susceptible of being drained for agriculture; the effect of drainage on such lands; the area of land which has been drained under the laws of the different States and the benefits which have resulted therefrom; a summary of the legislation of different States and methods under which drainage works have been constructed, and a review of the drainage laws and policies of leading agricultural countries in Europe.

Respectfully,

JAMES WILSON, Secretary.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., April 20, 1908.

SIR: I have the honor to transmit herewith a report containing information upon the general subject of drainage of agricultural

lands, prepared under your instructions in accordance with a resolution passed by the Senate December 9, 1907.

Very respectfully,

E. W. ALLEN, *Acting Director.*

The SECRETARY OF AGRICULTURE.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., April 18, 1908.

DEAR SIR: In accordance with your instructions, I am herewith handing you a report prepared for the Secretary to supply information upon the general subject of drainage of agricultural lands, asked of him in a resolution passed by the Senate December 9, 1907.

By way of explanation, allow me to say that the statistical information supplied consists of estimates made from data furnished by correspondents in reply to circulars and personal requests sent out by this office. The information, while the best that can be obtained in the time given, is considered as only approximately correct. The digests of the drainage laws of this and other countries have been carefully made and are authentic.

Yours, sincerely,

C. G. ELLIOTT,

Chief of Drainage Investigations.

Dr. A. C. TRUE,
Director, Office of Experiment Stations.

SWAMP LANDS OF THE UNITED STATES.

By the act of Congress of 1850 all Federal swamp and overflowed lands were granted to the States in which they were located. By the decision of the Secretary of the Interior rendered August 17, 1858, this act did not apply to the swamp lands of States admitted into the Union after its passage. The term "swamp and overflowed lands," within the meaning of the act, refers to lands which, in their natural state, are unfit for cultivation by reason of their swamp or their overflowed condition.

The regulations relating to the subject gave the States the choice of two methods of selection:

First. The field notes of the Government survey could be taken as a basis for selection, and all lands shown by them to be swamp or overflowed, within the meaning of the act, which were otherwise vacant and unappropriated September 28, 1850, would pass to the States.

Second. The States could select the lands by their own agents and report the same to the Secretary of the Interior, with proof as to the correctness of their selections.

In the States which have adopted the second method of selection claims for large areas have been filed; which have been approved by the Secretary. The report of the Commissioner of the General Land Office for 1907 gives the following areas, claims for which under the act named have been approved, and also gives the number of acres

SWAMP LANDS OF THE UNITED STATES.

3

which have been actually patented to the several States to which the act applied:

Swamp-land claims approved and certified under various grants.

State.	Claims ap-	Claims ap-
	proved—total since dates of grant.	Lands pat- ented—total since dates of grant.
Alabama.....	419,325.76	418,520.14
Arkansas.....	7,695,637.26	7,685,255.21
California.....	2,078,444.93	2,042,214.99
Florida.....	20,458,866.46	20,139,584.76
Illinois.....	1,497,028.35	1,457,380.98
Indiana.....	1,266,075.75	1,254,20.73
Iowa.....	942,180.67	871,702.71
Louisiana.....	9,385,026.27	9,316,626.88
Michigan.....	5,731,608.68	5,655,533.16
Minnesota.....	4,583,588.77	4,356,485.39
Mississippi.....	3,341,057.98	3,282,645.80
Missouri.....	4,498,573.28	3,345,514.51
Ohio.....	26,271.95	26,251.95
Oregon.....	355,749.62	253,493.46
Wisconsin.....	3,353,067.86	3,251,102.34
Total.....	65,582,503.59	63,356,541.01

The total of the approved claims is 65,582,503.59 acres, and the lands actually patented to the several States named amount to 63,356,541.01.

The adjustment still goes on, claims for 36,732 acres having been approved, and for 235,722 acres having been rejected during the past year. With reference to this matter, it should be noted that Illinois has reported claims for nearly 4,000,000 acres of swamp land, but claims for less than 1,500,000 have been approved, and that of the 4,500,000 claimed by Iowa, only 940,000 acres have been approved.

UNRECLAIMED SWAMP AND OVERFLOWED LANDS.

The following is an estimate of the number of acres of swamp and overflowed lands in the several States, which may be reclaimed for agriculture, exclusive of the coast lands which are overflowed by tide water. The acreage given is that obtained from the most recent information secured by correspondence with officials of the counties in the States represented:

State.	Acres.	State.	Acres.
Alabama.....	1,479,200	Nebraska.....	512,100
Arkansas.....	5,911,300	New Hampshire.....	12,700
California.....	3,420,000	New Jersey.....	326,400
Connecticut.....	30,000	New York.....	529,100
Delaware.....	127,200	North Carolina.....	2,748,160
Florida.....	19,800,000	North Dakota.....	200,000
Georgia.....	2,700,000	Ohio.....	155,047
Illinois.....	925,000	Oklahoma.....	31,500
Indiana.....	625,000	Oregon.....	254,000
Iowa.....	930,500	Pennsylvania.....	50,000
Kansas.....	355,380	Rhode Island.....	8,064
Kentucky.....	444,600	South Carolina.....	3,122,120
Louisiana.....	10,196,605	South Dakota.....	611,480
Maryland.....	192,000	Tennessee.....	639,600
Maine.....	156,520	Texas.....	2,240,000
Massachusetts.....	59,500	Vermont.....	23,000
Michigan.....	2,947,439	Virginia.....	800,000
Minnesota.....	5,832,308	Washington.....	20,500
Mississippi.....	5,760,200	West Virginia.....	23,900
Missouri.....	2,439,600	Wisconsin.....	2,360,000

The lands above enumerated are not all permanently unfit for cultivation in their natural state, but part of them are swamp or are subject to such frequent overflows from streams as to be entirely

unproductive, while a part are only periodically rendered unfit for cultivation by reason of their wet condition. The lands named in the foregoing list are properly those which may be wholly reclaimed from either a permanently or periodically swamp or overflowed condition.

With reference to their productive value as affected by their natural wet condition, they may be classified as follows:

First. Lands which are permanently wet and are never fit for cultivation, even during the most favorable years, nor afford profitable grazing for live stock.

Second. Lands which afford pasture for live stock, though the forage they produce may be of indifferent quality.

Third. Lands which in their natural condition are subject to periodical overflow by streams, but which at other times produce valuable crops.

Fourth. Lands which during seasons of light or medium rainfall will yield profitable crops, but which are wholly unproductive during the seasons characterized by a greater than the normal rainfall.

The following classification of the swamp and overflowed lands, with reference to these differences, represents approximately their relative agricultural value as affected by water conditions. All of these classes of land require draining to fit them for profitable cultivation, though a revenue of greater or less amount is periodically derived from all except the first class:

Classification of unreclaimed swamp and overflowed land.

State.	Permanent swamp.	Wet graz- ing land.	Periodic- ally over- flowed.	Periodic- ally swampy.	Total.
Alabama	Acres. 900,000	Acres. 59,200	Acres. 520,000	Acres. 1,479,200	
Arkansas	5,200,000	50,000	581,000	131,300	5,912,300
California	1,000,000	1,000,000	1,420,000	.....	3,420,000
Connecticut .....	.....	16,000	20,000	.....	30,000
Delaware	50,000	50,000	27,000	200	127,200
Florida	18,000,000	.....	1,000,000	800,000	19,800,000
Georgia	1,000,000	.....	1,000,000	700,000	2,700,000
Illinois	25,000	500,000	450,000	.....	925,000
Indiana	15,000	103,000	500,000	10,000	625,000
Iowa	300,000	200,000	350,000	80,500	930,500
Kansas .....	.....	59,380	300,000	.....	359,380
Kentucky .....	.....	100,000	300,000	44,600	444,600
Louisiana	9,000,000	.....	1,196,605	.....	10,196,605
Maryland	100,000	.....	92,000	.....	192,000
Maine	156,520	.....	.....	.....	156,520
Massachusetts	20,000	.....	39,500	.....	59,500
Michigan	2,000,900	947,439	.....	.....	2,947,439
Minnesota	3,048,000	2,000,000	.....	784,308	5,832,308
Mississippi	3,000,000	.....	2,760,200	.....	5,760,200
Missouri	1,000,000	.....	1,439,690	.....	2,439,690
Nebraska .....	.....	100,000	412,100	.....	512,100
New Hampshire	5,000	.....	7,700	.....	12,700
New Jersey	326,400	.....	.....	.....	326,400
New York	100,000	100,000	329,100	.....	529,100
North Carolina	1,000,000	500,000	500,000	748,160	2,748,160
North Dakota	50,000	50,000	50,000	50,000	200,000
Ohio .....	.....	.....	100,000	55,047	155,047
Oklahoma .....	.....	.....	31,500	.....	31,500
Oregon	254,000	.....	.....	.....	254,000
Pennsylvania .....	.....	.....	50,000	.....	50,000
Rhode Island .....	.....	.....	6,000	2,064	8,064
South Carolina	1,500,000	.....	622,120	1,000,000	3,122,120
South Dakota	100,000	.....	511,480	.....	611,480
Tennessee	639,600	.....	.....	.....	639,600
Texas	1,240,060	1,000,600	.....	.....	2,240,060
Vermont	15,000	.....	8,000	.....	23,000
Virginia	600,000	.....	200,000	.....	800,000
Washington	20,500	.....	.....	.....	20,500
West Virginia .....	.....	.....	23,900	.....	23,900
Wisconsin	2,000,000	.....	.....	360,000	2,360,000
Total	52,665,020	6,826,019	14,747,805	4,766,179	79,005,023

In addition to the above total area of 79,005,023 acres of wet land, it is estimated that there are 150,000,000 acres of what is now known and occupied as farm land, which is too wet for the most profitable cultivation, and whose production would be increased 20 per cent by proper drainage.

EFFECT OF DRAINING SWAMP LANDS UPON PUBLIC HEALTH.

The effect of draining swamp and overflowed lands upon the public health is shown by a decrease of malarial diseases and of mortality due to them. Such diseases prevailed to an alarming extent in the greater portions of Indiana, Illinois, and Iowa, prior to the construction of extended drainage systems in those States. The census of 1870 gives the number of deaths from malaria for the preceding year as 52.5 per thousand of the total, while the census of 1890 gives the deaths due to malaria at 8.6 for one thousand. During that time large areas of land in those States were drained, with the result that lands which were formerly swamp and unfit for cultivation were converted into productive farms. It is safe to conclude that these changes in malarial conditions were due to draining.

In support of this conclusion, the following comparison of malarial conditions in States where the swamps and wet lands were not drained during the same period is here given. From the census of 1870 it appears that the deaths from malaria in the lowlands of the Mississippi River from Cairo to the Gulf during the preceding year were 89.8 per thousand of the total. In the census of 1900 we find that for the same territory the deaths from this disease were 88.8 per thousand, showing practically no change in this regard. It is also noted that during the two decades named no material amount of land drainage was done in that section. For the southeast coast lands of South Carolina, Georgia, and Florida the deaths from malaria in 1870 were 66.2 per thousand, and in the same territory in 1890 they were 61.7 per thousand. These figures show that malarial conditions did not change in these sections during the two decades. It is also observed that little agricultural drainage was executed during the same time.

Drainage operations in some districts which were once malarious show that such work has had a remarkably beneficial effect upon the health of the people living within their boundaries. The white people of James Island, opposite the city of Charleston, S. C., were formerly obliged to leave the island during the summer months on account of the prevalence of malaria. Since the general introduction of drainage upon the farm lands of that section, no difficulties of this kind have been experienced, and white people now remain upon the island during the entire summer season without suffering from malaria. Some exceptional malarious localities in Charleston County, S. C., have been made completely sanitary within the last five years by means of drainage ditches constructed under the authority of the sanitary and drainage commission of that county. It is noted that a particularly unwholesome locality about 7 miles from the city has been made by drainage so thoroughly sanitary that a large manufacturing plant now occupies the ground that was formerly considered dangerous for white men to live upon. Should these operations be extended to the 2,000,000 or more acres of lands of the coast

region in that State, it is safe to predict that the sanitary condition would be improved in the same ratio as in the drained lands of Indiana, Illinois, and Iowa previously noted.

BENEFITS TO AGRICULTURE.

The benefits that would accrue to agriculture from thoroughly draining the lands classed as swamp and overflowed will be, first, the addition of 79,005,023 acres which are now waste, to the productive area of the country. This land will differ greatly in value when reclaimed, since it is found in widely different climatic conditions, and does not possess equal natural fertility, nor will it be possible to cultivate all of it with equal profit.

The reclamation of swamp lands consists of three distinct operations:

First. The construction of ditches or improvement of such drainage channels as will be required by a large number of landowners in common, and which may be appropriately called public drains. They are made through the cooperation of owners under the provisions of State drainage laws.

Second. Detailed drainage performed by landowners upon plantation or farm.

Third. The subjugation of wild vegetation, the removal of stumps and other foreign material, and the preparation of the soil for cultivation.

LANDS OF THE FIRST CLASS.

Taking an average estimate, we may place the cost of making public drains at \$4 an acre, and in addition, private drains required to place the land in productive condition at \$8 per acre, and the cost of subduing and reducing the cultivation at \$5 an acre. With this total expense of \$17 an acre, swamp lands should be placed in a condition to produce a profitable crop. It should be understood, however, that some classes of land will cost more and some less than the amounts named. A fair estimate of the advance in market price, due to drainage alone, above the cost of the work, is \$20 an acre. Should the 52,665,020 acres of swamp and overflowed lands be improved in this manner, the total increased value of land available for agriculture would be \$1,053,300,400.

A more important asset will be the annual net production from the reclaimed land, since the improvement is a permanent one and the proceeds from the investment will be continuous. A conservative estimate of the net income from farm lands producing staple crops may be taken at \$3 an acre, making the net annual receipts from the first-class lands named \$157,995,060.

LANDS OF THE SECOND CLASS.

In the second class, namely, those lands which are too wet for cultivated crops but have a value for grazing or for forage, the cost of thorough drainage would be nearly the same as for the first, but the increase in value would be perhaps only \$15 an acre, and the increase in net annual income \$2.50. Applying these estimates to the 6,826,019 acres in that class of land, the total increase of value will be \$102,390,285, and the total annual increase, at \$2.50, will amount to \$17,065,047.

LANDS OF THE THIRD CLASS.

Lands of the third class are those which are periodically overflowed by streams, aggregating 14,747,805 acres, have a value, but the crops being uncertain and entirely lost periodically, places the market value of the land at about \$15 an acre. The cost of protecting lands bordering the smaller streams by levees may be estimated at \$12 an acre, where pumping plants are not required. The benefit accruing to such land arises from the elimination of the loss of crops, which occurs at regular intervals, but sometimes two or three years in succession. If one crop is lost from overflow every four years, the annual additional return, provided the land is adequately protected, may be safely taken as \$6 an acre, and the increase in market value, due to this protection, at \$20 an acre above the cost of reclamation. Applying these estimates to the class of land named, the increase in value will amount to \$294,957,100, and the annual income be enhanced \$6 an acre, or \$88,486,830.

LANDS OF THE FOURTH CLASS.

The fourth class, or those which are periodically swampy and unfit for cultivation, is estimated at 4,766,179 acres. These lands are occupied as farms, but are not profitable for cultivation, though frequently producing large crops when weather conditions are favorable. It has a higher market value than the other three classes. The cost of public drains for this class of lands will be about \$3 an acre, and private farm drains \$10 an acre additional, the market value of the land being increased by such works \$30 an acre over and above the cost of improvement. The annual return or income will be increased 50 per cent, or at least \$2 an acre. The total increase in value of this class will be \$142,985,370, and the increased annual income \$9,532,385.

Tabulating the above figures we have the following:

Estimated increase in land values and in annual income from draining the swamp and overflowed lands in the United States.

Class.	Increased market value.	Annual increased production.
First.....	\$1,053,300,400	\$157,995,000
Second.....	102,390,285	17,065,047
Third.....	294,957,100	88,486,830
Fourth.....	142,985,370	9,532,358
Total.....	1,593,633,155	273,079,295

STATE GENERAL DRAINAGE LAWS.

General drainage laws have been enacted in 23 of the States, all of which are considered operative, and sufficient to accomplish the purpose for which they were made. In 12 of these States large areas of wet lands have been reclaimed under their provisions. In the other 11 States the laws have not been in force for a sufficient length of time for the completion of large drainage works, though large projects have been inaugurated and are in process of construction in several of the States last referred to. It is estimated that the follow-

ing areas in the States named have been drained under the provisions of the State drainage laws.:

	Acres.
Illinois	3,496,000
Indiana	3,358,000
Ohio	3,400,000
Michigan	1,600,000
Minnesota	1,500,000
Iowa	915,000
California	700,000
Missouri	350,000
Wisconsin	200,000
Nebraska	100,000
North Dakota	150,000
Louisiana	120,000
Total	15,889,000

The States of Arkansas, Mississippi, Kansas, Texas, and Washington have drainage laws similar to the above States, and have under consideration the execution of projects of considerable magnitude. The States of Utah, South Carolina, Oklahoma, Colorado, and Montana have laws, the efficiency of which has not been fully tested. All other States of the Union, except Alabama, Georgia, Nevada, Wyoming, and West Virginia, have drainage laws, some of which were enacted at an early date, but are not now regarded adequate for use in cooperative agricultural drainage.

AN OUTLINE OF THE STATE DRAINAGE LAWS UNDER WHICH MOST OF THE WORK NAMED HAS BEEN ACCOMPLISHED.

State drainage laws apply to lands which can not be drained or protected from overflow by their owners without crossing the land of others in the construction of ditches or of works for the improvement or control of natural streams. The laws relate to works of a common or public nature, which must be executed in order that owners may drain their lands for profitable agricultural use. They are enacted to permit owners to cooperate in the construction of such works under provisions which will secure to them adequate drainage outlets and protection from overflow, an equitable distribution of the cost, remuneration for property appropriated or injured for the common good, and security in the possession of outlet drainage rights.

The commencement of any drainage work under a State law must originate with the owners of land or legal representatives of corporate bodies who desire to have the improvements made. In theory no legislation is constitutional which may not apply to all citizens of the State under like conditions. For this reason nearly all of the State laws distinctly specify that "drains may be located, established, constructed, and maintained, and drains and water courses may be cleaned out, straightened, widened, deepened, and extended whenever the same shall be conducive to the public welfare or will be of general utility." The courts have in many instances ruled that the drainage of swamp and overflowed lands for uses of agriculture is a public benefit, and the drainage laws of some of the States so define it. Drainage works, however, contain a large element of individual profit or benefit which frequently dominates the element of public benefit, and the payment of their cost, with a few exceptions, is

assessed against the property in proportion to the benefit conferred upon it by the work.

The following outline covers the essential features of the laws under which more than 15,000,000 of acres of wet land in the United States have been converted from an unhealthy and unprofitable state to wholesome and valuable farming land:

First. Authority is given to the county court, circuit court, or to the county commissioners or supervisors to administer the law, and all proceedings are kept within the jurisdiction of the county, no report being required to be made to the governor or other State official, except in the case of South Carolina and under one of the laws of California. Where the work is performed in more than one county, the boards of the counties concerned may cooperate.

Second. The board is empowered to receive and act upon a petition calling for the construction of drains, when signed by the required number of landowners. The petition must describe the land which the petitioners desire to have drained and state the character of the work desired. The laws of some States require that the petition contain the names of the owners whose lands will be affected. It must be accompanied by a bond conditioned upon the payment of all costs in case the board refuses to grant the petition.

Third. If the petition filed complies with the law, the board shall appoint a commission or board of viewers, and direct that an examination and survey be made of the area described in the petition, and that a report be filed with the board containing a description of the lands that will be benefited or damaged, the kind and amount of drainage required, and other information which may be necessary for the board to decide intelligently upon the legality and merits of the project.

Fourth. The board shall give notice by publication or in some instances by personal service, of the filing of the report, and shall fix a time for hearing and considering objections which may be made by landowners to the work named in the petition.

Fifth. After considering the report of the viewers and engineer, and hearing all objections made by landowners, the board may dismiss the matter at the cost of the petitioners, or may declare the district organized, in which latter case the petitioners are relieved from obligations to pay costs thus far incurred.

Sixth. When the district or ditch is established and designated by number or name, as may be required by law, the board shall order a complete survey, map, and plans to be made by an engineer, whom they may appoint, or by the county surveyor, if the law makes him engineer by virtue of his office, and a report to be filed containing an estimate of the cost and a description of the lands benefited or damaged.

Seventh. After consideration of the report the board may amend and adopt the plans, and shall then appoint one commission to award damages and another to assess the benefits, but some laws provide that both duties shall be performed by the same commission.

Eighth. The commission appointed to assess the benefits shall apportion the cost of the work to each tract of land, according to the benefit it will receive by reason of the construction of the work shown in the plans, and file the assessment roll with the board.

Ninth. The board shall appoint a day of hearing at which time landowners may appear and file objections to the amount of damages appraised or benefits assessed against their property. The board may change or amend the assessment roll if in their judgment such action is required to make it equitable, after which it shall be confirmed.

Tenth. The work called for by the plans adopted shall be executed by contract awarded by the board under competitive bids, and the work shall be performed under the supervision of an engineer appointed by the board, who shall direct and inspect the work as completed, and certify to the amount performed.

FUNDS AND PAYMENTS.

The assessments against each property are special, and become a first lien upon the property. When collected, they are covered into a drainage fund, kept separate by the county treasurer, from which all expenses or costs pertaining to the work must be paid.

The preliminary costs are paid from the county treasury, which is reimbursed later from the drainage fund.

In a large number of the States the bonds of the district secured by a lien upon the land may be issued for 90 per cent of the cost of the work, provided the landowners so decide by an elective vote, or in some cases so request in the original petition, and when sold, the proceeds are used to defray the expense of the work. The bonds shall be sold at not less than par, bearing interest at the rate of 5 per cent, and in no State exceeding 8 per cent, and may run from five years to twenty years, as may be determined by the vote of the taxpayers, the limit varying in the different States.

RIGHTS OF LANDOWNERS.

Landowners have the right to file protests or objections to the proceedings of the board which is charged with administering the laws, at times appointed for hearings, and may appeal from the decisions of the board to the circuit court.

In case drainage bonds are issued, any owner has the privilege of paying his assessment before the bonds are issued, thus relieving himself of the lien which is placed upon the land in virtue of the confirmation of the assessment.

Every owner assessed for benefits to his property has the right to a perpetual outlet into any ditch or drain established by the district. Remuneration must be made to owners for property damaged or injured in carrying out the drainage plans adopted by the board.

DIFFERENCES PECULIAR TO STATES

Michigan.—Each county board appoints one drainage commissioner, who has direction of all cooperative drainage, and is required to report his actions to the board of county commissioners.

Mississippi.—Upon the presentation to the chancery court of the first petition for drainage in any county, the board of supervisors shall elect three drainage commissioners, who are authorized to direct all drainage work which shall subsequently be petitioned for in the county.

Minnesota.—A State drainage commission, consisting of the governor, State auditor, and secretary of state, has direction of the drainage of State lands which is authorized by appropriations made by the legislature. The sum of \$545,000 has so far been appropriated for the drainage of State lands. Drainage of lands in private ownership is provided for by the general drainage law.

Montana.—The law has a provision for the appointment of a permanent drainage commissioner by the county commissioners of each county. At his request three viewers must be appointed by the district court to consider each drainage project petitioned for and report to him upon the same.

Indiana.—The law of 1907, which is a codification of all laws previously enacted, directs the board of county commissioners to appoint a permanent drainage commissioner, to hold office for two years or until his successor is appointed. A petition for drainage shall be filed in the circuit court, and then be referred to the drainage commissioner of the county, who, with the county surveyor and a third commissioner appointed by the circuit court, shall conduct the proceedings thereafter.

South Carolina.—A sanitary and drainage commission of three or five for each county is appointed by the governor upon the request of the State representatives and senators, or a majority of them, in whose district the county is located.

ASSESSMENTS.

The laws of Texas, Utah, and one of the California laws require assessments for the cost of drainage to be made on the basis of assessed valuation of the land included in the district.

Florida.—The State law provides that lands may be assessed a fixed sum not exceeding 10 cents per acre for drainage.

South Carolina.—Property benefited shall be assessed equitably for the cost of the improvement, and such assessment shall be approved by the legislature before it can be collected.

Louisiana.—Limitation controlling the assessments for the cost of drainage are that the annual tax shall not exceed 5 mills on the dollar of assessed valuation, and may be in the form of an annual tax not exceeding 50 cents per acre.

DRAINAGE LAWS OF FOREIGN COUNTRIES.

DRAINAGE LAWS OF ENGLAND.

The public moneys drainage act.—The first law is known as the “Public moneys drainage act of 1846.” Its object, as expressed in the preamble, is to facilitate works of drainage by advances of money to a limited amount on the security of the land to be improved. The following is a brief outline of this law:

1. The landowner is to make application to the inclosure commissioners for a loan, stating the condition of the land to be drained, estimated expense, and the increase of value which will probably result from the drainage proposed.

2. The commissioners may issue to the landowners a provisional certificate declaring that when the works have been properly executed

they will cause an advance to be issued for the expense, provided no one having a charge upon the land dissents.

3. When the works have been executed, the commissioners issue an advance and the land is charged with payment to the Crown at the rate of 6 pounds 10 shillings per centum, payable in 22 years. The sum of 2,000,000 pounds for Great Britain and 1,000,000 pounds for Ireland was set aside by this act for advances. This act was amended in 1847 to include the expense of making outlets upon the water courses, fencing and clearing of land, and limiting the time for the completion of the work to five years.

The private moneys drainage act.—The private moneys drainage act of 1849, as stated in the title, was to permit the advance of private money for drainage of lands in Great Britain and Ireland. The preamble states that the whole of the advances authorized by the public drainage act of 1846 had been applied for and appropriated, and that it was expedient that money should be advanced by private individuals and the landowners should be enabled, with the sanction of the inclosure commissioners, to borrow or advance money to be expended in draining lands. At this time land drainage and improvement companies were incorporated, with authority to construct drainage works and from whom landowners could borrow money for such improvements, payment to be secured by rentals from the land. Government aid to drainage does not seem to have been furnished after 1849.

Land drainage act of 1861.—The most complete drainage law is that enacted in 1861, entitled the “Land drainage act,” and applies to England alone. Under this law elective drainage districts are authorized under the sanction of the inclosure commissioners, the cost of the work being charged against the rentals of the land and paid in annual installments, principal and interest running over a period not exceeding thirty years. The following is the method of procedure prescribed:

1. A petition signed by the proprietors of not less than one-tenth part of the acreage of any land that requires a combined system of drainage, shall be presented to the inclosure commissioners, describing the area for which drainage is desired and guaranteeing the costs of the preliminary work provided the district shall not be established.

2. The inclosure commissioners shall send an inspector to the district to examine the same and report.

3. If the report is favorable, the commissioners may issue a provisional order, which, when confirmed by act of Parliament, establishes the district.

4. Superintendence and administration of matters relating to the district shall be exercised by a drainage board elected by property holders, subject to the provisional order under which the district is constituted.

There is a similarity in many essentials between this act and the drainage laws of our States. In England the proposed work must be examined by the inclosure commissioners, the plans approved, and a provisional order issued, which must be confirmed by act of Parliament. The lands being entailed, the cost of the work is necessarily distributed over a long period of time in order that the successive occupiers of the land may participate in the payments for the work as well as the benefits derived from the same.

DRAINAGE LAWS OF FRANCE.

Drainage projects in France are divided into two classes, (*a*) those undertaken by the Government; (*b*) those undertaken by associations of landowners.

Drainage by the Government.—Drainage work performed by the Government covers only projects of too vast extent to be undertaken by associations of landowners, or those considered necessary but which the owners refuse to undertake themselves. In this case the Federal Government does the work and apportions one-third of the cost to itself, one-sixth to the Department (corresponding to our State), and one-half to the owners of the land. The procedure in cases of this kind is as follows:

1. The Government designates lands the drainage of which it regards as useful and necessary and submits the proposition to the landowners.

2. A meeting of the latter is called to decide on whether they will undertake the work or not.

3. Should they refuse to drain their lands the Government decides whether it will undertake the work itself or grant it to a concessionary.

4. Plans are drawn up by the Government engineers (or if granted to other parties these must be approved by them), and they have general engineering supervision of the project.

A special commission is appointed by the President of France to have charge of the whole work. A board of appraisal, one member of which is designated by the minister of public works, one by the prefect of the Department (corresponding to the governor of a State), and one by a syndicate representing the landowners, is appointed by the President to make assessments and determine damages. The findings of this board must be approved by the departmental legislative assembly, which also has the right to decide any disputes arising between the State and the landowners, except on the question of assessments, from which there is a final appeal to the Presidential commission in charge of the work.

The two most notable projects accomplished under this law embraced 1,640,000 acres of land. The Forez project, completed in 1879, included 140,000 acres, and the project of Les Landes and La Gironde, completed in 1865, comprised 1,500,000 acres. Of this area one-half belonged to towns who paid their assessment for the cost of the work by the sale of 466,000 out of 720,000 acres of the drained lands owned by them. The maintenance of these works is under the supervision of the prefects of the Departments in which the lands are located, but the cost is paid by the owners of the land.

Drainage by associations of landowners.—There are two kinds of associations which are authorized to perform drainage operations, (*a*) those organized by mutual consent, (*b*) those in which a majority of landowners control the organization.

In the first class any owner or owners may construct drains through lands owned by members of the association but are not granted privileges which are accorded to quasi public associations.

The procedure in associations of the second kind is as follows:

1. A petition is presented to the prefect of the department signed by one or more landowners stating their desire to form a drainage association.

2. A public meeting is called of all the landowners within the proposed district and a vote taken to ascertain their wishes with respect to forming a drainage association. If two-thirds of the owners of the land, which pay three-fourths of the taxes, or three-fourths of the owners, which pay two-thirds of the taxes, vote in favor of the association the petition is—

3. Submitted by the prefect to the minister of public works for a decision as to the public utility. This decision must be based on the advice and approval of a local improvement committee, as well as the departmental commissioner of agriculture.

4. On the approval of the petition a meeting of all the landowners of the district is called by the prefect to elect—

(a) Officers of the association.

(b) A representative assembly to make all necessary rules and by-laws and to apportion assessments and damages.

(c) A board of trustees to have charge of the maintenance and construction of the work.

Under this law which was enacted in 1865 and has been amended and construed in 1888 and 1894, there have been organized over 50 associations embracing over 70,000 acres. Previous to 1865 there was a similar law under which many thousands of acres were drained and the associations still exist for their maintenance.

If private individuals find it necessary in order to properly drain their lands to cross neighboring lands, they may do so by paying just damages, which may be determined by a justice of the peace.

Powers of associations.—These associations may appropriate property by eminent domain and may cause milldams to be removed in consideration of an indemnity which is awarded by the representative assembly and must be approved by the prefect of the Department. Towns and Departments in which the district is located may always be represented by their mayors or prefects in a deliberative capacity. If any aid is granted by the Federal Government, it must be represented on the board of trustees.

Federal aid.—Aid may be granted by a loan from a fund of 100,000,000 francs (\$20,000,000) which was set aside in 1856 to encourage irrigation and drainage operations. The sum which may be loaned for drainage each year by the minister of public works is specified in the law of finances. Loans are payable in 25 annual installments with accrued interest at 4 per cent collected as regular taxes and constituting a lien upon the land.

DRAINAGE LAWS OF PRUSSIA.

The drainage laws of Prussia relate only to drainage of lands performed by owners either individually or united into associations for this purpose. Large projects, such as the reclamation of moors and fens, which are usually Crown lands, are undertaken by the Government, but there is no statute law governing these operations. The Russian Diet or legislative body makes special enactments and regulations for each separate project.

Private drainage associations.—Private associations are especially for carrying out small projects, and the only requirement for their establishment is a legal contract between the owners. These are more of the nature of partnerships and are in no way controlled by the Government.

Public drainage associations.—Public associations having for their object the drainage of extensive tracts of land, the owners of which are not unanimous in their desire for the work, may be incorporated with the approval of the minister of agriculture and the provincial or communal authorities. The proposed work must be shown to be of public utility, and beneficial to agriculture, and must be favored by a majority of owners, to secure the approval of the minister of agriculture. Provinces in which there is much wet or swamp land have imperial commissions to advise the minister of agriculture in this respect, and to assist associations in conforming to the requirements of the law and making their plans acceptable to the authorities. These commissions prepare instructions covering the points to be observed in preparing plans for the work.

The procedure is as follows:

1. A petition is presented to the minister of agriculture covering the general scope of the project and containing a list of all owners whose land will be affected.

2. If approved it is referred to the Prussian Diet (legislative assembly) for an act of incorporation, and thereafter the association will be under the supervision of the local authorities (town or province).

3. Detailed plans are then prepared and the authorities having jurisdiction appoint a board of experts to determine whether in order to carry out these plans it will be necessary to appropriate land, remove dams from rivers, or otherwise interfere with private property. If so, they may issue orders to that effect.

4. The assessments are made upon lands in proportion to benefits, and the damages are appraised by a court of awards appointed by the authorities, which shall consist of one of the claimants for damages, one of the landowners desiring the work, and one other member. Appeal may be made from the findings of this court to the judicial authorities.

The association is self-governing, but is under the general supervision of the district authorities. The total cost is assessed against the land benefited, and is collected as regular taxes. For the purpose of furnishing funds so-called agrarian banks, which may be incorporated by the legislative bodies of the district, are permitted to issue bonds or to make cash loans to these associations. Before these banks are permitted to furnish aid, satisfactory proof must be presented that the proposed work is practicable and will improve the lands at least to the extent of the cost of the work. Loans obtained from these banks are secured by a first mortgage on the lands, and are repaid from the excess of rent over and above the 4 per cent interest which is required by law.

Reclamation of the Government swamp land.—The State has given much encouragement to the tenants of Crown lands to enable them to properly drain the same. Since 1868 an average of 400,000 marks (\$95,000) has been annually appropriated for loans to these tenants.

The State undertook the drainage of moors and fens in 1890, which work previous to that time had been done by the provinces, and appropriated, from 1892 to 1901, 1,722,000 marks (\$408,000) to carry out the work. There is a central moor commission appointed by the State to superintend and advise on these projects and to conduct an experiment station for investigating the best methods of marsh

improvement. These lands when reclaimed are colonized by the State, which obtains returns for its investments from the sale or rent of the lands. The interest on sums so invested by the State has averaged 4 per cent or more.

DRAINAGE LAWS OF BELGIUM.

In Belgium provision is made for the drainage of agricultural lands by the organization of public associations and by individuals through proceedings before a justice of the peace.

Drainage by associations.—The larger works of drainage in Belgium are undertaken by associations of property owners called "wateringues." They are established by the Government pursuant to a request of the provincial assembly setting forth the necessity of the proposed work, and are composed of all owners of at least $2\frac{1}{2}$ acres of land in the district to be drained. Towns included in the district are represented in the associations by their mayors, who have only deliberative powers, and the provincial government by the governor or his appointee.

The minister of public works defines provisionally the limits of the project, the owners to be included in the association and the make-up of its general assembly. The functions of this assembly are legislative, and consist of levying assessments for benefits, allotting damages, preparing the estimates of cost, making regulations for the special needs of the locality, and nominating candidates for the administration of the work. In addition, it is the duty of these assemblies to have plans prepared which shall be submitted, together with a report of their proceedings, to the provincial assembly for the approval of that body, then to the minister of public works, and finally to the King for confirmation.

The execution of the work for which these associations are organized is carried out by a drainage board under the general supervision of the Government engineer of roads and bridges for the district wherein the marsh is located. This board is selected by the King from the list prepared by the assembly of the "wateringue."

Drainage by individuals.—Private drainage operations may be carried out by individual landowners, and are distinguished from work performed under associations, which are quasi public in character. Landowners who wish to drain their lands may procure the right of drainage over intervening lands to an outlet, provided they indemnify the owner. In cases of disagreement between the parties the amount of the indemnity may be decided by a justice of the peace, whose findings shall be final in cases involving less than \$20. Justices of the peace have general supervision over works of this character, but appeals from their decisions may be taken to the courts.

DRAINAGE LAWS OF ITALY.

Drainage works are here divided into two classes.

The first class is wholly for sanitary purposes and may be undertaken by the State, provinces, communes (towns), or landowners, and the cost is shared by all. The State has complete jurisdiction over these, but may delegate the work to the provincial or communal governments or the landowners interested.

The second class may only be undertaken by the landowners individually or by associations formed for the purpose. In this case the funds are furnished by the different governments and the landowners. If the initiative is taken for the formation of associations to do work of this class by town, province, or State each shall contribute a share, but if the owners take the initiative they must bear the whole expense.

Works of the first class.—In works of the first class the State pays six-tenths, the province one-tenth, the commune (town) one-tenth, and individual landowners two-tenths of the cost. Contributions may be required of the provinces or communes even if their lands are not included within the actual boundaries of the district, if it is shown that they are in any way benefited. The cost of the work, including the building of roads, bridges, and other structures necessary to make the reclaimed lands accessible, is assessed to each party in proportion to benefits. The Government engineers have charge of the construction work. The plans, estimates, assessments, and boundaries must be approved by a ministerial decree, and the boundary of the district must be approved by the superior council of public works and by the council of State. A final reapportionment of the cost is made on completion of the work, but the State's share is not altered from that of the original estimate. Towns must levy a special tax to pay their share, and this assessment constitutes a lien on the lands of those assessed. When the work is performed by any other party than the State, said party is entitled to the part of the cost paid by the State, and interest on it at 4 per cent until paid. In case private property is taken, damages are awarded by a court of arbitration representing the minister of public works, the owners, and the judiciary. Appeals may be taken from the awards of this court to the courts of law.

Works of the second class.—The second class of projects must be performed by associations of landowners under the prefect (governor) of the province. These may be voluntary or compulsory. The former may be organized by mutual consent of the interested parties and are entitled to all privileges granted to compulsory associations.

Compulsory associations may be formed either on the initiative of the government or that of the landowners.

If the government suggests the formation of the association, a hearing is given to the landowners, and the town and provincial councils vote on the question. If the vote of both is negative, the district may not be organized. If it is in favor, the district is organized and one-tenth of the cost is borne by the State, one-tenth by the province, one-tenth by the commune (town), and the remaining seven-tenths by the landowners interested; but on the completion of the work the State, province, and commune may demand repayment of their share in not more than ten annual payments without interest.

If the initiative is taken by the landowners, the association may be authorized by the minister of public works, but must be approved by the minister of agriculture, by a Federal standing commission on public works, and by the state council. In this case the total cost is borne by the landowners.

Associations may levy taxes in proportion to benefits, take private property required in carrying out drainage work, and borrow money. Taxes may be collected as regular taxes and loans may be negotiated

from established banks in sums not to exceed three-fifths of the estimated value of the land included in the district. Bonds may be issued with the approval of the minister of agriculture, industry, and commerce.

On the completion of the work in this class also the total cost is reapportioned among those liable to assessment, and the difference between the actual and estimated cost collected or returned as the case may be. Increases in returns from lands under provisions of this drainage law are exempt from land taxes for twenty years.

Work accomplished and provided for.—The amount of work in drainage done and projected in Italy may be judged from the following figures, which show the amount of money allotted by the State: For work in progress in 1900 and including work up to 1924 to be built by the State, 63,500,000 lire (about \$12,380,000), to be paid by State, province, commune, and landowners interested in the proportions required by the law; for prospective projects, 119,424,000 lire (about \$23,287,000) in the same proportion. For additional works provided for under the law relative to work by associations there was allotted 63,000,000 lire (\$12,285,000), to be contributed by State, province, commune, and landowners interested according to the law regarding such classes of drainage work. This was to cover work done under the law from 1903–1933.

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